Annotated Table of Contents: "Writing for Telepathy: Practicing the Craft of Scientific Writing", by Stephen B. Heard

Some features of content and approach will be common to most chapters. These include:

- Interesting links between science writing and science itself (for example, in 4.1 the psychological concept of "theory of mind" as it relates to revising one's writing). These should draw reader interest, since the readers are scientists, but also make clear why certain writer behaviours or writing techniques work (or don't).
- Brief coverage of background in history and philosophy of science to explain why we write the way we do (for example, in 5.1 some history of coauthorship). This kind of element is primarily to help readers see interest in the material beyond mere descriptions of current conventions in writing and publishing, which can be very dry.
- Interesting anecdotes about personalities and entertaining asides (for example, in 1.1 Newton's deliberate rewriting of the Principia to make it harder to read, and in 4.1 a metal-punk band named from the writing advice of Sir Arthur Quiller-Couch). Used too liberally, these can be distracting, but I've found from teaching that in moderation such embellishments can grab and hold reader attention and draw them through the serious material of the book.
- Real illustrative examples of flawed writing, taken from my own early drafts and, with permission and some disguising, from other manuscript drafts I've reviewed and handled (for example, in 4.1 I admit to my own terrible overfondness of parentheses and address how I fight back). I will seek writing examples from fields other than biology as well. These will speak to scientists better than synthetic examples, because they can be both concrete and personal.

Below are very brief synopses of intended content for each chapter. However, content points mentioned are representative, not exhaustive. The synopses cannot indicate much about the style, but the two provided sample chapters should illustrate that.

Part I. What this book is about

1.1 On Bacon, Hobbes, and Newton, and the selfishness of writing well. (Complete chapter draft provided)

*Central message:* that good writing is "telepathic" in the sense of clear, effortless receipt of your message by the reader. You should work to achieve this not as a service to science (although it is that), but so that you will have readership and impact - hence, "selfishness". This chapter's function is to motivate the rest of the book.

*Approach and content:* Begins with a brief history of scientific writing, focused on the founding of the Royal Society and the first scientific journals. I argue that this is when scientific writing first took on the objective of clarity, and explain why writing before this was designed to be unclear, but after this to be clear. This leads to a motivational argument for the importance of telepathic writing in the sciences, and for the transferability of that craft to other fields.
1.2 Genius vs. practice

*Central message:* While there are a very few "natural writers" out there, for nearly all of us scientific writing is a craft, one that we can get better at by practicing. This chapter's function is to empower scientific writers by having them see the gains that can be realized by deliberate, conscious attention to writing process and writer behaviour, not just the production of content.

*Approach and content:* Begins with a description of one of the few natural writers I've met, who produces publication-ready 1st drafts. I explain that I once thought that was normal, but now realize it's the rare exception; I believe that many young writers have the same misconception that I did. I explain how my realization changed my writing career by making hard work at the craft seem a normal part of my job, not some horrible penalty I alone paid for being a bad writer. This motivates discussion of some general writer behaviour arises from thinking of writing as a craft (for example, reading with attention to writing, drafting and redrafting, etc.)

1.3 What this book is, and isn't, about

*Central message:* This isn't a book about grammar rules, or citation formatting, or table layouts. Although all those things come up, this book isn't an exhaustive guide to them; instead, it complements exhaustive technical guides that are available. Instead, this book is about how an ordinary scientific writer can learn to write better and better, so that readers can get the message easily and so that those readers can give the work impact.

*Approach and content:* Begins with some examples of dry rules of grammar and composition, then explains that there are books on the shelves that are encyclopaedic references to such things, and that this book complements but does not replace them. Then moves to discuss what writers really need to learn: how to directly and consciously engage with their own practices and behaviour as they write, in order to efficiently produce high-quality writing.

This is a brief chapter, primarily introducing expectations for the rest of the book.

**Part II. Actually writing: behaviours**

2.1 Managing your writing behaviour: Scheduling, etc.

*Central message:* It's extremely useful to pay explicit attention not just to the content of what you are writing, but to your own behaviour as you write it.

*Approach and content:* Begin with a story about my own slow writing and my realization that I procrastinate and distract myself a lot. The solution was to consciously manage my own writing behaviour by scheduling (refers to "How to Write a Lot" by Paul Silvia on this particular issue). Then broaden this argument: many writers pay attention to the
content of what they are writing, but not to themselves as writers. Understanding and managing your own behaviour as a writer is the key to actually accomplishing all those things that you know you are supposed to accomplish: all the way from correct punctuation through to career-long productivity.

This is a brief chapter, making the general argument for behavioural self-awareness and self-management; many more specific instances follow.

2.2 Starting

Central message: Beginning a writing project can be a sticking point for many writers, but this can be overcome with some behavioural awareness. In scientific writing, the "beginning" stage can even be eliminated completely by integrating the process of writing with the rest of the research project, and this can help both the writing and the research itself.

Approach and content: Begins by acknowledging the common sticking point of getting started. Provides some advice on how to overcome difficulty beginning, such as easing into writing with straightforward sections (acknowledgements, methods, tables) to build momentum. Then argues for integrating writing with the rest of the research program. For instance, a good time to write a Methods section is before or during execution of an experiment. Writing it then can make the writing easier, but equally importantly can strengthen the experimental design by alerting you to features of the design that are ill-advised before it's too late. Similar arguments can be made for synergies arising from early drafting of other subsections. Ends with the notion that considered this way, writing doesn't really start and stop and is no longer a distinct, mechanical step, but is an integral part of the whole scientific enterprise.

2.3 Outlining

Central message: Outlining, whether formal or informal, is essential in deciding what scientific "story" you intend to tell your readers. Few scientific writers think of their work as constructing a story, but they should. Failing to consciously consider what the story is, and thus what goes in the paper and what doesn't leads to overlong, poorly organized, and overcomplex manuscripts.

Approach and content: Begins with an argument for the importance of defining the story to be told. This contrasts the common "everything I did in the order I did it" way of going wrong with the ideal of information chosen and arranged by how it helps the reader understand the scientific story the writer wishes to tell them. Discusses ways of ordering material when there are multiple experiments, subsections, etc. Then considers different styles of outlining, formal and informal, to help achieve this. Discusses use and overuse of on-line supplements.
This is a critical chapter because failure to carefully define the "story" is one of the most common flaws I see in manuscripts by early-career writers. Paying attention to this early can make the rest of the writing much easier and the product much better.

2.4 Keeping going

*Central message:* A career in science (or even just a thesis!) means producing a sizeable quantity of writing (not just papers, but grants and reports), and this is very hard if you lose a lot of time to "writer's block". Building and maintaining momentum is important.

*Approach and content:* Begin with some examples of productive scientists' publication rates, and with some simple calculations about sustained rates of writing these imply. Then discuss behavioural strategies for maintaining writing momentum, including scheduled writing, progress charts, writing groups, task switching. An important argument is for holding one's nose to producing a first draft, no matter how ugly it is (enlivened with interesting contrasts featuring non-science writers' approaches to production - Flaubert, Vonnegut vs. Hemingway, Simenon).

This is a short chapter and one in which the message is not particular to the sciences.

**Part III. Actually writing: content and style**

3.1 Rules: when to follow them, and when to break them

*Central message:* Rules (of grammar, etc.) matter because, and only when, they work to help achieve telepathy in writing. In scientific writing, you should hew much closer to the formal rules than is appropriate in other disciplines.

*Approach and content:* Some simple examples of grammar rules, their violation in ways that make text confusing or misleading, but also their violation in ways that improves writing. Argues that the latter instances are unusual in scientific writing, and that only by knowing the rules can you decide when they are best broken. This chapter is *not* a comprehensive treatment of rules but will motivate the reader to own and use a complementary grammar-and-style reference.

3.2 Structure and Sections

*Central message:* A standardized structure for the scientific paper exists as a way to work with rather than against reader expectations for where information can be found. Good structure leads the reader inexorably through a story.

*Approach and content:* Begins with brief history of scientific paper structure, from freeflow narrative and "virtual witnessing" (1600s) to canalization of Abstract/Intro-/Methods/Results/Discussion structure. Explains the reasons for this convention and argues for the value of "hourglass structure" (beginning the Introduction and ending the
Discussion with broad importance, with the most specific detail at the waist of the hourglass in Methods and Results). Then considers less conventional paper structures, including methods-last, combined results-discussion, reviews, theory papers, etc.

3.3 Paragraphs

Central message: Within sections, paragraph organization provides the structural framework for the text and carries the reader through the "story".

Approach and content: Begins with the notion of paragraphs as largely independent units, with clear transitions joining them. Discusses ideas like topic sentences, paragraph length, sequencing of paragraphs within a larger section, the use in scientific writing of subsections and subheads, etc. (This chapter and the next two are probably the least specific to scientific writing, although they will still use the science-centric approach of the 'common features' outlined above.)

3.4 Sentences

Central message: Simple and clear sentence design lightens the load on readers.

Approach and content: Focus on sentence design strategies to achieve telepathy. Important topics include sentence length and complexity, active/passive voice, ambiguous construction (such as dangling modifiers). While these issues are very general in writing, there are some interesting science connections. For instance, treatment of sentence complexity includes an analogy to the use of stacks in computer programming (bad sentences have the reader load phrases into mental "stacks" until only at the end the key point is revealed and the stacks can be unloaded). Discussion of active vs. passive voice, and the reason for changing fashions in our journals, includes some interesting history of claims to objectivity in scientific rhetoric.

3.5 Words

Central message: Appropriate word choice lightens the load on readers.

Approach and content: Discussion of what makes a word the right one; vocabulary, terminology and the expected audience. Use of jargon when it achieves clarity, and avoidance when it does not (for instance, 'use', not 'utilize'; but 'polyacrylamide', not 'gel'). Importance of knowing word meanings both in dictionary and common usage, so you work with reader's expectations (for instance, using "exception that proves the rule" in its dictionary-correct sense will only confuse most readers).

3.6 Figures and tables

Central message: Poorly designed figures and tables are big obstacles to readers; well designed ones help make your story clear.
Approach and content: Begins with a real example of an offputting table (from my own published work) and an offputting figure (with permission, from something I've reviewed). Argues that we use figures and tables in scientific writing because of complex logical and quantitative material that isn't well expressed in text, and that's precisely why careful design is critical. Brief discussion of clear design, appropriate level of detail, uses of tables vs. figures vs. in-text numbers, use of colour, etc. This chapter-length treatment cannot be comprehensive, so the chapter will primarily expose readers to the issues and motivate them to consult complementary works such as Tufte's *Visual Display of Quantitative Information*.

3.7 Literature Citations

Central message: Working on citations is dull at best and infuriating at worst, but is part of your responsibility as an author in science.

Approach and content: Everyone hates dealing with citations, so motivate this with importance of citation-rate data for careers; you want people to cite your works correctly so they can be tracked, so you must do the same for your peers. How citations work to your advantage as a scientific writer by marking your knowledge of literature context. When citations are needed (and how many) and when they are not. Keeping track of citations as you write; strengths of software vs. other methods. Brief coverage of citation styles (mostly, that one defers to journal style).

This is a short and rather utilitarian chapter.

3.8 Brevity

Central message: In scientific writing, publishers, readers, and writers are all best served by concise writing (albeit for different reasons). Nearly all of us naturally produce overlong writing, so explicit and ruthless attention to brevity is important.

Approach and content: Begins with the observation that an editor will ask you to condense nearly every manuscript you ever submit - followed by an explanation of why doing so is actually in the best interests of publishers, readers, and writers. Then covers techniques for concise writing and for revision for brevity. Discusses (and illustrates) some common sources of excess length, including passive voice, jargon, padding phrases, circumlocutions, redundancy, and parentheticals. Many connections back to material in 2.3 and 3.2 - 3.6, and forward to material in 4.1.

Amusingly, this will likely be one of the longer chapters in the book, because length seems like a minor technical issue to many scientific writers, but is in fact central and tied in with a lot of other issues (voice, outlining, determining the story, etc.)
Part IV. Revising

4.1 Self-revision (Complete chapter draft provided)

Central message: Few of us write review-worthy drafts without revision. Extensive rewriting (not just polishing) is essential if we aren't to abuse the goodwill of colleagues and reviewers. The key trick to effective self-revision is learning to see your own work as a reader will see it.

Approach and content: Begins with the need for self-revision, and the distinction between self-revision, friendly reviews, and formal reviews. Argues for limited self-revision during writing of the first draft, but for extensive and intensive self-revision (not just polishing) later. Then introduces the most important trick to effective self-revision: reading your draft as if you were the reader, not the writer ("reader simulation"). This is related to the psychological concept of "theory of mind", and to elements of the psychology of memory and cognitive performance that can be exploited to accomplish reader simulation. Finally, I suggest a way of breaking down the self-revision process into steps to make it easier and more effective.

4.2 "Friendly" reviews

Central message: You can and should use colleagues and friends for a round of review before submitting a manuscript for publication. Knowing how to make review easy for your reviewer will make sure your colleagues say 'yes'.

Approach and content: Begins with the reasons for using this review step - to get reaction from "real" readers before risking the manuscript's fate in formal review. Discusses how to choose the best friendly reviewers (e.g., people in the same general field, but not in the same lab) and how to ask them. How to present a manuscript that's easy to review, and how to read and deal with a review once you get it back. Also covers the special case of "iterated friendly review" - repeated revisions for supervisors, etc.

4.3 Formal reviews

Central message: Understanding formal (journal, etc.) reviews as a source of help rather than a set of antagonistic gatekeepers can greatly improve your mood as well as your writing.

Approach and content: Begins with an outline of typical review processes in science, and what to expect from scientific journals, editors, and reviewers, including differences between formal and friendly reviews. Covers how and when to suggest preferred (or nonpreferred) reviewers. Discusses how to interpret and respond to constructive reviews, and how reviews that appear unconstructive can almost always be constructive too, if you know how to read them. Finishes with discussion of how and when to correspond with editors outside of the normal review process.
4.4 The "response to reviews"

_Central message:_ When you resubmit a revised manuscript, the "response to reviews" document is at least as important as the revisions themselves, and a good one is not hard to write.

_Approach and content:_ Introduces the "response to reviews" document (which very few new writers have been taught to write, and many have never even heard of). Outlines how to write one that makes it easy for the handling editor to accept your paper. How to describe changes you've made to comply with reviewer suggestions, and how to explain disagreements with reviewer suggestions in ways that don't seem obstructive.

**Part V. Miscellaneous**

5.1 Managing coauthorships

_Central message:_ Most scientific writing is now done in teams. Writers need to know how to decide what contributions merit authorship and how to write with colleagues.

_Approach and content:_ Begins with some history of coauthorship in scientific publishing, with reasons for the increasing fraction of coauthored papers. Establishes that all scientific writers need to know how to manage coauthorships. Discusses guidelines for determining authorship, and argues that guidelines alone aren't enough; prospective collaborators need to have explicit, up-front discussions about authorships. Provides approaches for making those discussions less awkward. Briefly discusses conventions for order of authorship, and how they vary among fields. Concludes with a section on how to write and revise as part of a team - options for dividing tasks, technological tools, how to deal with slow coauthors, etc.

5.2 Writing forms other than journal papers

_Central message:_ Switching from a journal paper to another writing form requires adjustments. The key to these adjustments is understanding what each specific audience needs.

_Approach and content:_ Begins with an overview of the different kinds of writing a scientist might need to produce, including journal papers, book chapters, monographs, grant proposals, technical reports, and nontechnical writing (essays, blog posts, magazine articles, media briefing notes, etc.) This is illustrated by my own typical year of writing. Brief discussion of differences in publishing process among forms. The heart of the chapter is a discussion of differences in writing style among forms, and this centres on understanding the needs of different audiences. Concludes with a discussion of the value of different writing forms to scientific careers (both traditional academic and other).
5.3 The next project

Central message: When writing is seen as an integral part of a scientific research program, it makes sense for it to be a constantly ongoing thing rather than a step you work on, complete, and leave behind.

Approach and content: This wrap-up chapter will echo the argument from 2.2 that writing should not be seen as a distinct task that one takes on, completes, and leaves behind. Rather, writing is an integral part of what we do as scientists and we should be weaving writing into everything else we do. This will strengthen our work itself, and avoids problems with loss of momentum between projects.

This is a short chapter and functions also to draw together the major threads (writing for telepathy, writing as a craft, managing writer behaviour, tied into the integration of writing with the rest of the scientific enterprise).